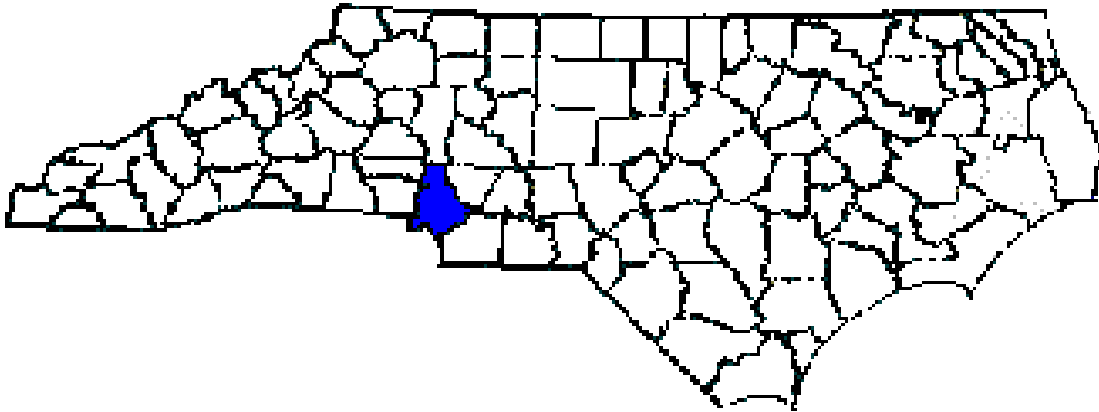
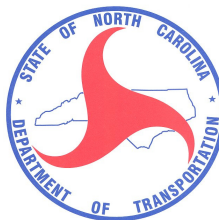


# ANNUAL REPORT FOR 2009



**Unnamed Tributaries to Doby Creek Mitigation Site  
Mecklenburg County  
TIP No. I-3803A**



Prepared By:  
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## **SUMMARY**

The following report summarizes the stream monitoring activities that have occurred during the Year 2009 at the Unnamed Tributaries to Doby Creek (UT to Doby Creek) Mitigation Site in Mecklenburg County. This site was constructed during 2005 by the North Carolina Department of Transportation (NCDOT). This report provides the monitoring results for the fourth formal year of monitoring (Year 2009). The Year 2009 monitoring period was the fourth of five scheduled years for monitoring on UT to Doby Creek (See Success Criteria Section 2.1).

Based on the overall conclusions of monitoring along UT to Doby Creek, it has met the required monitoring protocols for the fourth formal year of monitoring. The channel is stable throughout the stream at this time, except for a beaver dam located downstream of photo point #3. NCDOT will contact the U.S. Department of Agriculture to remove the beavers and beaver dam from the site. The streambank and buffer area are highly vegetated for the fourth year of monitoring. The North Carolina Department of Transportation will continue stream monitoring at the UT to Doby Creek Mitigation Site for 2010.

## **1.0 INTRODUCTION**

### **1.1 Project Description**

The following report summarizes the stream monitoring activities that have occurred during the Year 2009 at the UT to Doby Creek Mitigation Site. The site is located adjacent to the southbound I-85 lanes at the US 29/49 interchange in Charlotte (Figure 1). The UT to Doby Creek Mitigation Site was constructed to provide mitigation for stream impacts associated with Transportation Improvement Program (TIP) number I-3803A in Mecklenburg County.

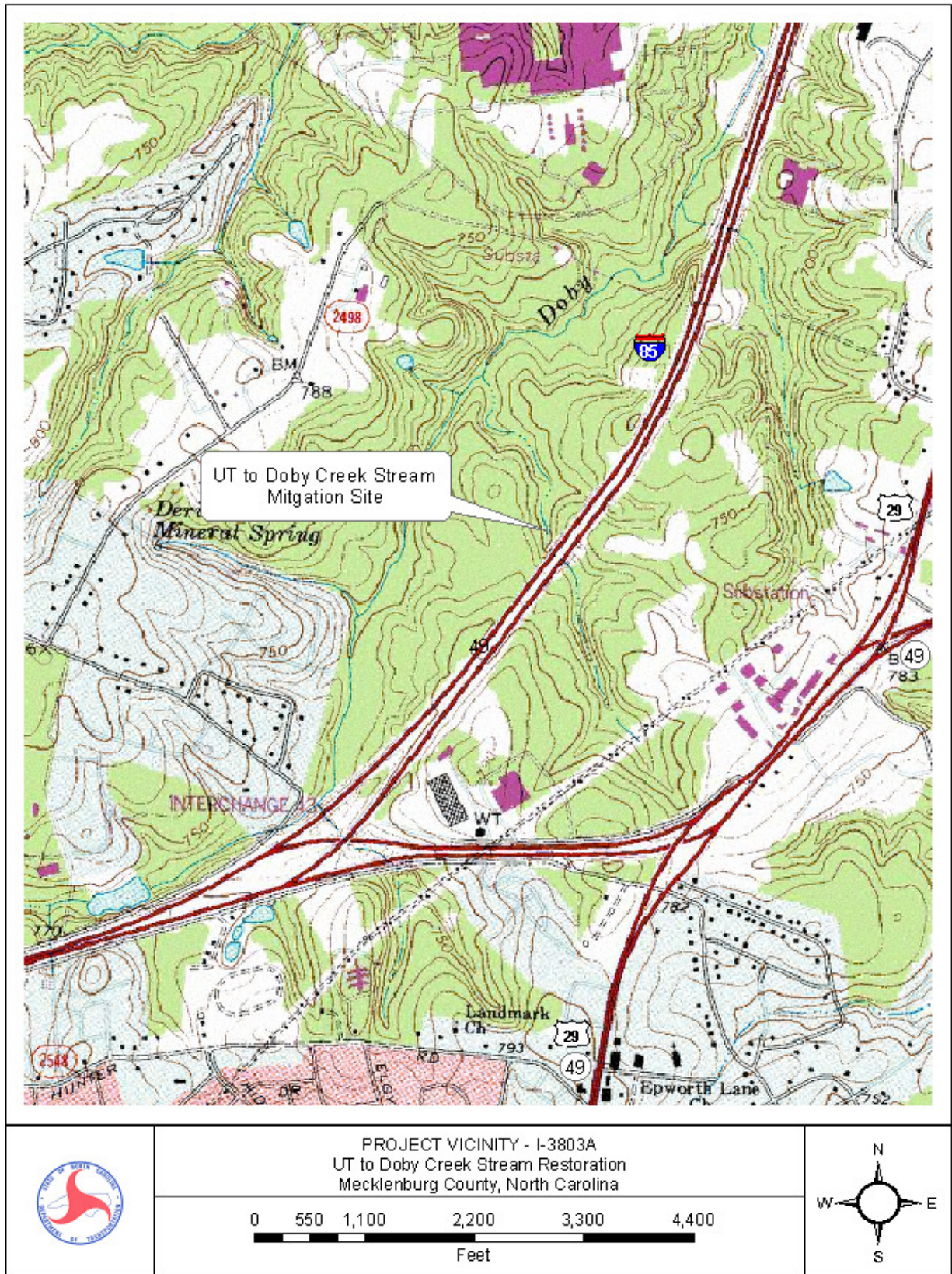
The mitigation project covers approximately 220 linear feet along the perennial reach and 347 linear feet along the intermittent reach. Construction was completed during 2005 by NCDOT. Stream restoration involved the removal of 152 linear feet of culvert along the perennial reach and 170 linear feet of culvert along the intermittent reach. The restoration also involved, new channel construction along both reaches, widening the floodplain to allow for major flood events, and the installation of cross vanes and coir fiber logs. Coir fiber matting was installed on the stream bank. Live stakes and bareroot seedlings were planted along the stream bank and in the floodplain.

### **1.2 Purpose**

In order for a mitigation site to be considered successful, the site must meet the success criteria. This report details the monitoring in 2009 at the UT to Doby Creek Mitigation Site. Hydrologic monitoring was not required for the site.

### **1.3 Project History**

March 2005	Construction Completed
March 2005	Planted Live Stakes and Bareroot Seedlings
August 2006	Vegetation Monitoring (1 yr.)
October 2006	Stream Channel Monitoring (1 yr.)
September 2007	Stream Channel and Vegetation Monitoring (2 yr.)
September 2008	Stream Channel and Vegetation Monitoring (3 yr.)
October 2009	Stream Channel and Vegetation Monitoring (4 yr.)



**Figure 1. Vicinity Map**

## **2.0 STREAM ASSESSMENT**

### **2.1 Success Criteria**

The following activities were conducted on the perennial reach. The intermittent reach will only be photographed yearly.

#### **Cross-sections**

Permanent cross-sections (either surveyed or located using GPS) will be established at a spacing of one per 20 bankfull-width lengths. Each cross-section will be marked on both banks with permanent pins to establish the exact transect used. The annual cross-section survey will include points measured at all breaks in slope, including top of bank, bankfull, inner berm, edge of water, and thalweg. Calculations will be made of width/depth ratio, entrenchment ratio, and low bank height ratio.

#### **Pattern**

Annual measurements taken for the plan view of the restoration site will include sinuosity, meander width ratio, and radius of curvature (on newly constructed meanders only for the first year of monitoring)

#### **Materials**

Annual pebble counts will be performed on all gravel-bed project reaches based on the percent of pools and riffles.

#### **Longitudinal Profile**

A complete longitudinal profile will be completed during the first year and then every two years for a total of five years (a total of 3 profiles). Measurements will include slope (average, pool, riffle) and pool-to-pool spacing. Survey points will include thalweg, water surface, inner berm, bankfull, and top of low bank. Each of these points will be taken at the head of each feature, e.g. riffle, run, pool, glide, and max pool depth.

#### **Bank Erosion Estimates**

A bank erodibility hazard index (BEHI) score will be made. An estimate of near-bank shear stress will be made by measuring the water surface slope along the observed bank length, as well as for the entire feature length, following the thalweg. Bank erosion estimates should be less than 0.1 yd<sup>3</sup>/year.

#### **Photo Reference**

Digital photographs should be taken along the perennial and intermittent reaches at permanent photo locations on an annual basis. Photographs should include photos of permanent cross-section locations, in-stream structure, success of vegetation, and any changes in the stream channel.



## **Survival Plots**

Survival of planted vegetation will be evaluated using survival plots or counts. Survival of live stakes will be evaluated using enough plots or a size plot that allows evaluating at least 100 live stakes. Evaluations of live stake survival will continue for at least 5 years. When stakes do not survive a determination will be made as to the need for replacement; in general if greater than 25% die replacement will be done.

Bare root vegetation will be evaluated using at least 2 staked survival plots. Plots will be 50 ft. by 50 ft. and all flagged stems will be counted in those plots. Success will be defined as 320 stems per acre after 5 years. When bareroot vegetation does not survive, a determination will be made as to the need for replacement; in general, if greater than 25% die, replacement will be done.

## **2.2 Stream Description**

### **2.2.1 Post-Construction Conditions**

The mitigation of UT to Doby Creek involved the removal of 152 linear feet of culvert along the perennial reach and 170 linear feet of culvert along the intermittent reach. The restoration also involved, new channel construction along both reaches, widening the floodplain to allow for major flood events, and the installation of cross vanes and coir fiber logs. Coir fiber matting was installed on the stream bank. Live stakes and bareroot seedlings were planted along the stream bank and in the floodplain.

### **2.2.2 Monitoring Conditions**

The objective of the UT to Doby Creek stream restoration was to build an E5 stream as identified in the Rosgen's Applied River Morphology. A total of two cross sections (one in a riffle and one in a pool) were surveyed. For this report, only cross sections containing riffles were used in the comparison of channel morphology presented below in Table 1. Data shown in Table 1 includes one cross section chosen to represent a riffle section.

Variable						
	Proposed	2006	2007	2008	2009	2010
		Cross-Section #1	Cross-Section #1	Cross-Section #1	Cross-Section #1	
Drainage Area (mi <sup>2</sup> )	.25	.25	.25	.25	.25	
Bankfull Width (ft)	11.0	11.32	11.55	11.6	10.58	
Bankfull Mean Depth (ft)	1.0	0.8	0.82	0.8	1.04	
Width/Depth Ratio	10.0	14.15	14.09	14	10.17	
Bankfull Cross Sectional Area (ft <sup>2</sup> )	11.3	9.05	9.46	9.7	10.97	
Maximum Bankfull Depth (ft)	1.3	1.49	1.54	1.7	1.83	
Width of Floodprone Area (ft)	30-35	40.1	40.1	40.1	40.1	
Entrenchment Ratio	2.7-3.2	3.54	3.47	3.5	3.79	
Slope	0.024	0.0239	N/A	0.0206	N/A	

\*Drainage Area, Floodprone Width, and Slope are averaged values only.

\*Riffle values are used for classification purposes, pool values are shown in Appendix A.

Particle Sizes (Reach Count)	Proposed	2006	2007	2008	2009	2010
D <sub>16</sub> (mm)	N/A	0.83	0.74	0.34	N/A	
D <sub>35</sub> (mm)	N/A	1.67	1.64	0.59	N/A	
D <sub>50</sub> (mm)	N/A	6.27	11.75	0.87	N/A	
D <sub>84</sub> (mm)	N/A	19.85	22.19	10.31	N/A	
D <sub>95</sub> (mm)	N/A	51.33	45	16	N/A	

## 2.3 Results of the Stream Assessment

### 2.3.1 Site Data

The assessment included the survey of two cross sections and the longitudinal profile of UT to Doby Creek established by the NCDOT after construction. The length of the profile along UT to Doby Creek was approximately 200 linear feet. The longitudinal profile will only be completed during monitoring years 2006, 2008, and 2010 (See Success Criteria Section 2.1). Two cross sections were established during the 2006 monitoring year. Cross section locations were subsequently based on the stationing of the longitudinal profile and are presented below. The locations of the cross sections and longitudinal profile are shown in Appendix A.

- ◆ Cross Section #1. UT to Doby Creek, Station 25.08 linear feet, midpoint of riffle
- ◆ Cross Section #2. UT to Doby Creek, Station 62.04 linear feet, midpoint of pool

Based on comparisons of 2008 to 2009 monitoring data, both cross sections appear stable with little or no active bank erosion. It was noted on the graph for cross section #2 pool that some of the sediment deposited into the channel from last year has moved downstream. The beaver dam located downstream of photo point #3 has caused some aggradation along the lower end the stream restoration project. Debris deposited onto



the floodplain suggest a bankfull event has occurred on site since the last monitoring evaluation in 2008. Graphs of the cross sections are presented in Appendix A. Future survey data will vary depending on actual location of rod placement and alignment, however, this information should remain similar in appearance. A representative pebble count was not taken in 2009 due to high water from beaver activity.

A bank erodibility hazard index (BEHI) and near-bank shear stress (NBS) scores were not determined in 2009 because the longitudinal profile was not completed per the permit conditions (See Success Criteria Section 2.1). The longitudinal profile is needed to complete the BEHI and NBS scores. A longitudinal profile, BEHI, and NBS will be completed in 2010 by NCDOT. Overall, the channel was highly vegetated and very stable at the time of monitoring. A beaver dam located downstream of photo point #3 on the stream restoration project had approximately half of the site inundated with water.

## 2.4 Results of Stream and Buffer Vegetation

### 2.4.1 Description of Species

The following live stake species were planted on the stream bank:

*Salix nigra*, Black Willow

*Cornus amomum*, Silky Dogwood

The following tree species were planted in the buffer area:

*Fraxinus pennsylvanica*, Green Ash

*Platanus occidentalis*, Sycamore

*Alnus serrulata*, Tag Alder

*Quercus phellos*, Willow Oak

*Betula nigra*, River Birch

### 2.4.2 Results of Vegetation Monitoring

**Stream bank Vegetation:** One live stake plot was set to determine if the success criteria was being met.

Plot #	Black Willow	Silky Dogwood	Total (4 year)	Total (at planting)
1	23	65	88	100

**Buffer Vegetation:** Two vegetation plots were set to determine the trees per acre in the buffer area.

Plot #	Green Ash	Sycamore	Tag Alder	Willow Oak	River Birch	Total (4 year)	Total (at planting)	Density (Trees/Acre)
1	2	8	3	3	3	19	20	646
2		3	9		4	16	23	473
Average Density (Trees/Acre)								560

**Site Notes:** Other vegetation noted: *Juncus* sp., cattail, woolgrass, tear-thumb, goldenrod, and various grasses. There was some missing planted vegetation within vegetation plot #2 due to the beaver activity but other hardwood vegetation (i.e. black willow and tag alder) were still abundant.

### 2.4.3 Conclusions

There was one live stake monitoring plot established along the stream bank. The 2009 live stake monitoring of the site revealed 88 live stakes were surviving within the plot. This meets the success criteria for year four monitoring.

There were two vegetation monitoring plots established throughout the buffer area. The 2009 vegetation monitoring of the site revealed an average tree density of 560 trees per acre. This average is well above the minimum success criteria of 320 trees per acre after year four monitoring.

## 3.0 OVERALL CONCLUSIONS/RECOMMENDATIONS

The UT to Doby Creek mitigation site has met the required monitoring protocols for the fourth formal year of monitoring. The channel and structures throughout the stream are stable at this time. NCDOT will contact the NCDA to remove the beavers and beaver dam located downstream of photo point #3 from the site. The streambank and buffer area are highly vegetated for the fourth year of monitoring. NCDOT will continue to monitor the UT to Doby Creek stream mitigation site in 2010.

## **4.0 REFERENCES**

Unnamed Tributaries to Doby Creek. Mecklenberg, NC, April 9, 2003

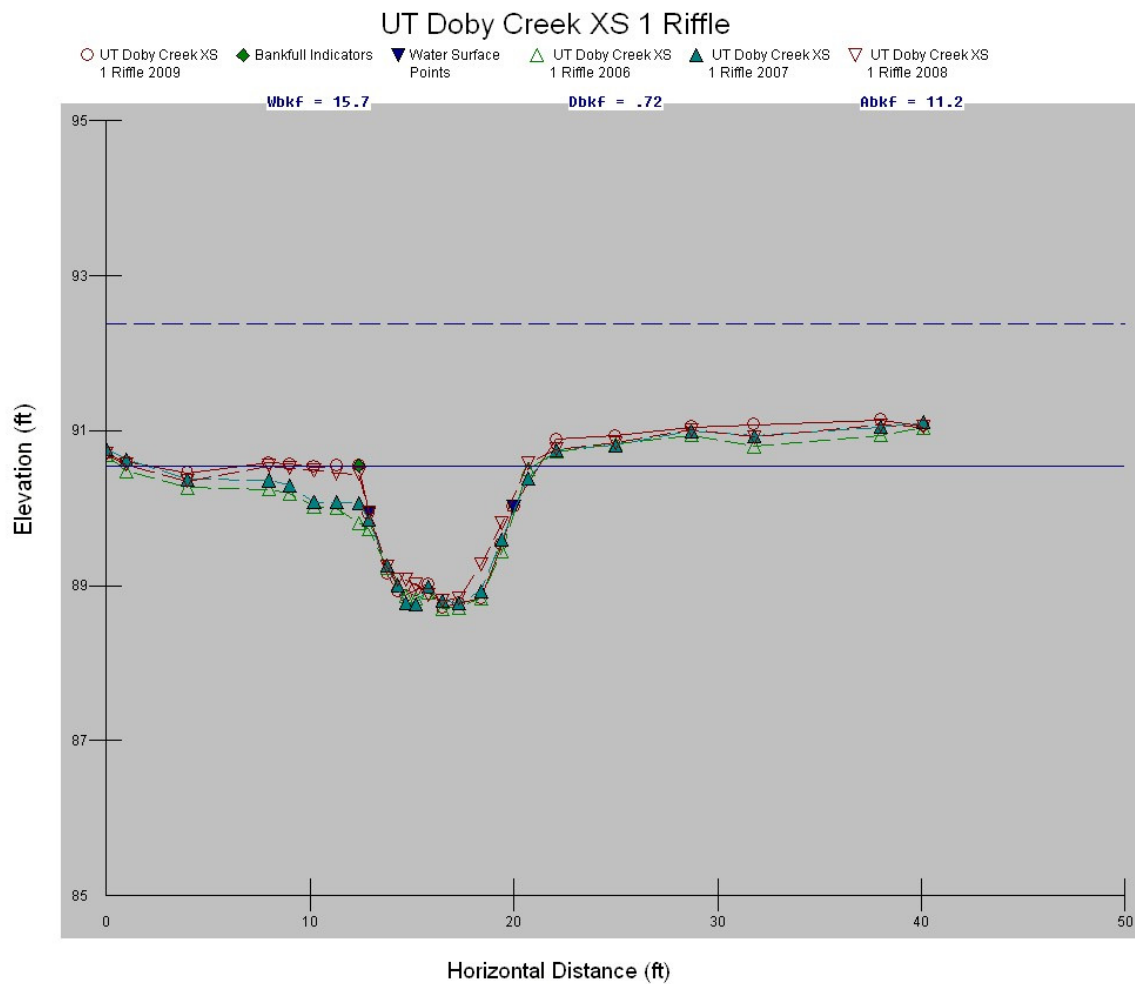
I-85 Widening (From US 29/NC 49 to Speedway Blvd. State Project No. 8.1675102, TIP No. I-3803A, USACE Action ID 202231338 (For LPA, by Buck Engineering)

Rosgen, D.L, 1996. Applied River Morphology. Wildland Hydrology, Pagosa Springs, Colorado.

US Army Corps of Engineers (USACE), 2003. Stream Mitigation Guidelines. Prepared with cooperation from the US Environmental Protection Agency, NC Wildlife Resources Commission, and the NC Division of Water Quality.

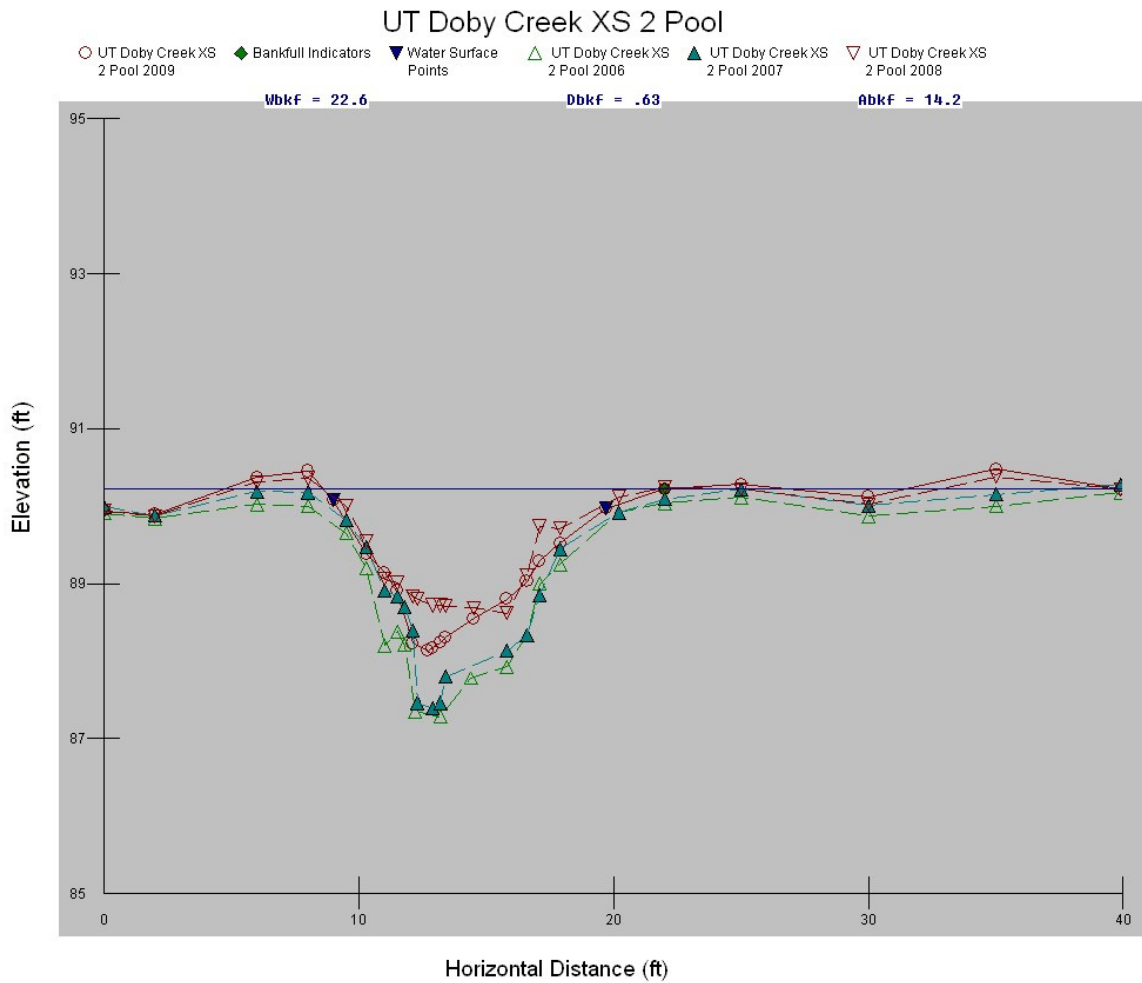
## **APPENDIX A**

### **CROSS SECTIONS AND LONGITUDINAL PROFILE COMPARISON**



Cross-Section #1 (Riffle) Abbreviated Morphological Summary					
	2006	2007	2008	2009	2010
Bankfull Cross Sectional Area (ft <sup>2</sup> )	9.05	9.46	9.7	10.97	
Maximum Bankfull Depth (ft)	1.49	1.54	1.7	1.83	
Width of the Floodprone Area (ft)	40.1	40.1	40.1	40.1	
Bankfull Mean Depth (ft)	0.8	0.82	0.8	1.04	
Width/Depth Ratio	14.15	14.09	14	10.17	
Entrenchment Ratio	3.54	3.47	3.5	3.79	
Bankfull Width (ft)	11.32	11.55	11.6	10.58	





Cross-Section #2 (Pool) Abbreviated Morphological Summary*					
	2006	2007	2008	2009	2010
Bankfull Cross Sectional Area (ft <sup>2</sup> )	16.85	15.09	11.01	12.89	
Maximum Bankfull Depth (ft)	2.75	2.7	1.62	2.09	
Bankfull Mean Depth (ft)	1.06	1.11	0.82	0.96	
Bankfull Width (ft)	15.85	13.63	13.5	13.38	

\* According to the Rosgen Classification of Natural Rivers floodprone width, entrenchment ratio, and width depth ratio are not measured in pool, glide, or run features.

**APPENDIX B**

**SITE PHOTOGRAPHS, CROSS SECTION AND**

**PHOTO POINT LOCATIONS**



# UT to Doby Creek

## Perennial Reach



Photo Point #1 (Vegetation Plot 1)



Photo Point #1 (Vegetation Plot 1)



Photo Point #1 (Vegetation Plot 2)



Photo Point #2 (Upstream @ X-Section #1)



Photo Point #2 (Downstream @ X-Section #2)  
October 2009



Photo Point #3 (Upstream)



# UT to Doby Creek

## Perennial Reach



Photo Point #3 (Downstream)



Beaver dam located downstream of Photo Point #3

October 2009



# UT to Doby Creek

## Intermittent Reach



Photo Point #1 (Upstream)



Photo Point #1 (Downstream)



Photo Point #2 (Upstream)



Photo Point #2 (Downstream)



Photo Point #3 (Upstream)

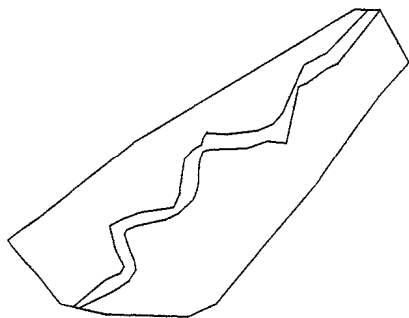


Photo Point #3 (Downstream)

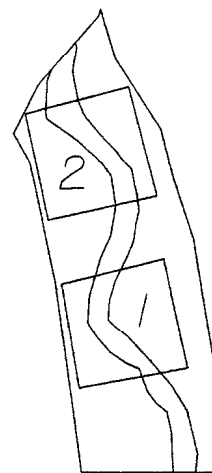
October 2009



*UT to Doby Creek  
1-3803A*



*Intermittent Reach*

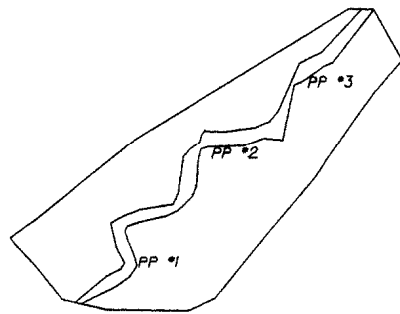


*Perennial Reach*

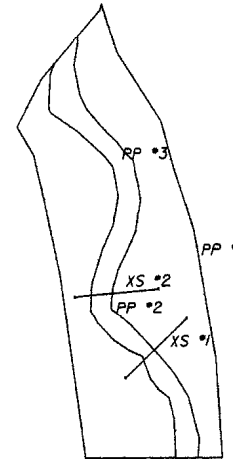
1	<i>Tree and Live Stake Plot</i>
2	<i>Tree Plot</i>



*UT to Doby Creek  
1-3803A*



*Intermittent Reach*



*Perennial Reach*

*Legend*

*XS - Cross Section*

*PP - Photo Point*